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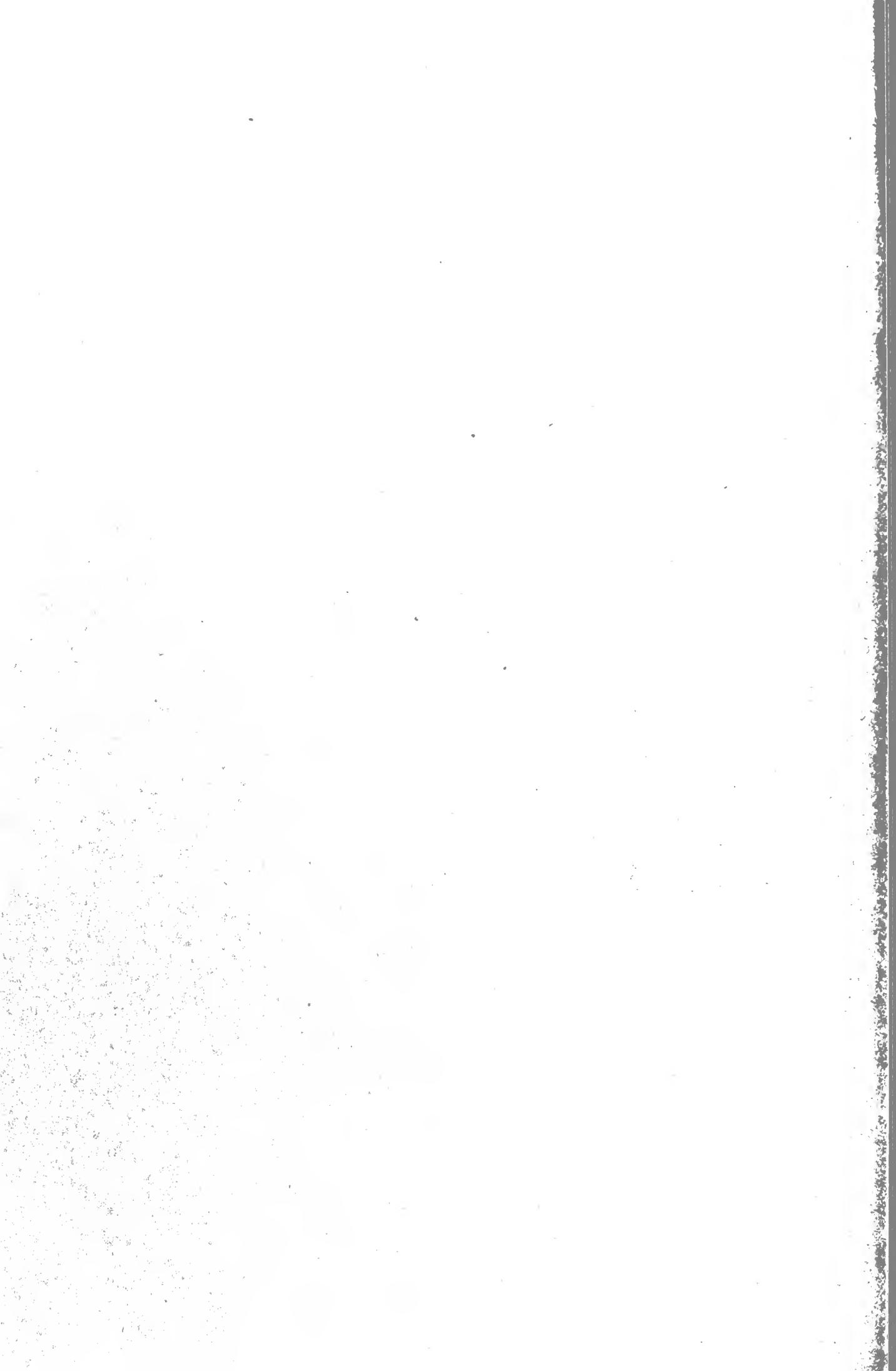
**THE KITAGAMIIDAE, A FAMILY OF CADDISFLIES NEW TO  
NORTH AMERICA (TRICHOPTERA)**

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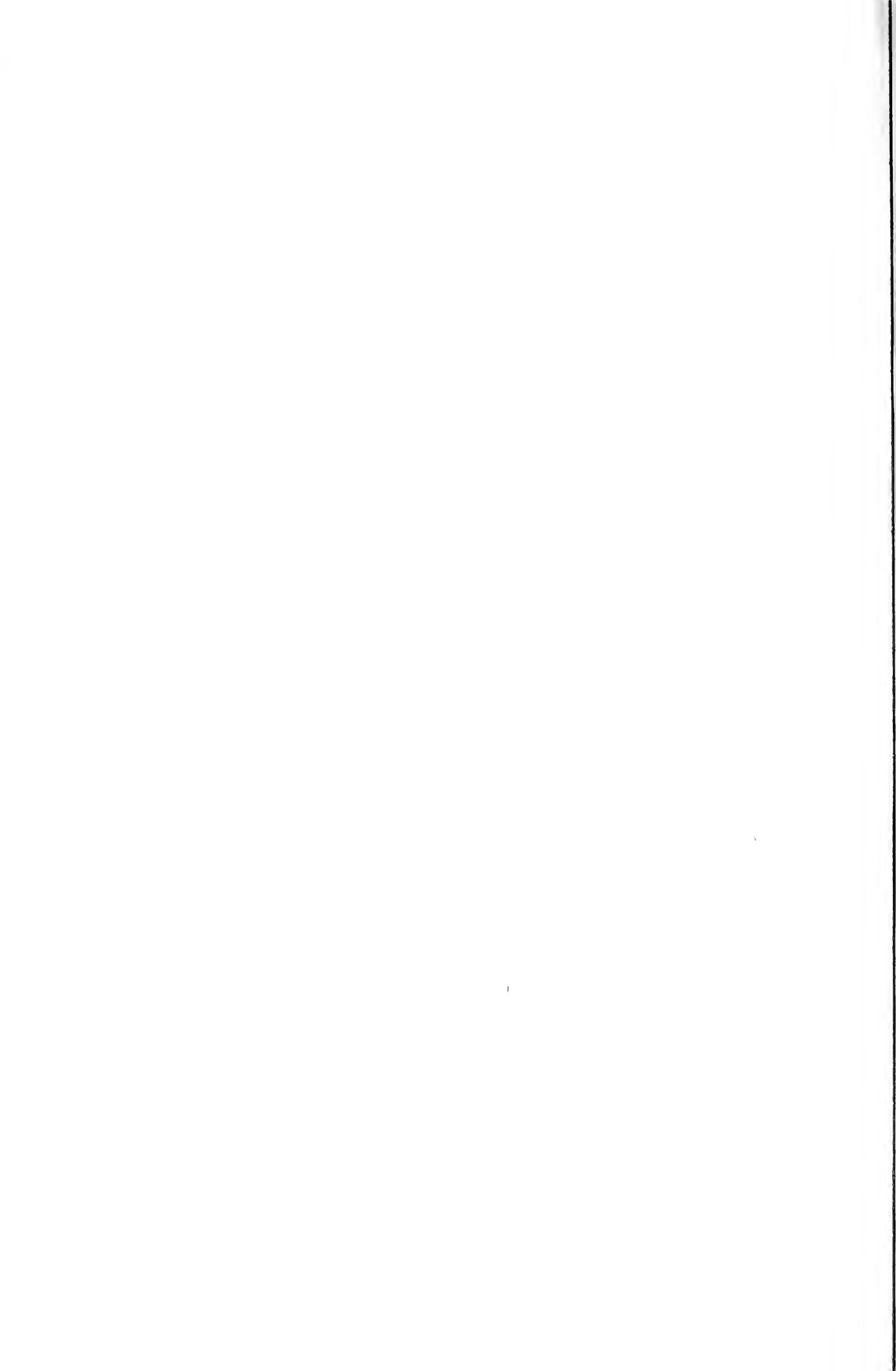
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# THE KITAGAMIIDAE, A FAMILY OF CADDISFLIES NEW TO NORTH AMERICA (TRICHOPTERA)

By GLENN B. WIGGINS

IN THE COURSE of present studies on the caddisfly family Phryganeidae, specimens of *Phryganea californica* Banks, known only from California, have been examined. It has been discovered that males as well as females of this species have five-segmented maxillary palpi. From this fact alone, *P. californica* cannot be retained in the Phryganeidae, as presently defined, where males of all other species possess only four segments in the maxillary palpi. Milne (1934) noted the five-segmented palpi in the one male of *californica* in the Museum of Comparative Zoology, but considered this an anomaly with partial gyandromorphism as a plausible explanation, and accepted the species as a phryganeid. The other two males examined in the present study also have five-segmented palpi, and thus there can be little doubt that this is the natural condition for the species.

Since this species does not conform to the present definition of the Phryganeidae, then what are its true relationships? Available evidence of adult structure strongly suggests that the closest relatives of *californica* are grouped in the Kitagamiidae.<sup>1</sup> A remarkable similarity in general form (Text-fig. 1) and in many structural details is apparent between this species and the kitagamiids. Both possess ocelli and have a tibial spur formula 2,4,4. The shape of the head, the position and number of head warts, the shape of the eyes, and the structure of the antennae are the same. Both have five-segmented maxillary palpi in each sex (Text-fig. 3A) and the relative lengths of the segments are about the same. The terminal segment of the maxillary palpi is not flexible as in the Philopotamidae and related families and the second segment is not subequal to the first as in the Rhyacophilidae. Both *californica* and the kitagamiids have rather narrow wings (Text-figs. 2, 3B) with a reduced anal area in the hind wing. The venation is basically the same with the division or lack of division of  $R_{2+3}$  the major difference between them.

On the other hand, the terminal abdominal segments of *californica* are not in such close conformity with their counterparts in the kitagamiids, although in certain structures smaller components of the total

<sup>1</sup>Following the recommendation in Paragraph 54 of the *Copenhagen Decisions on Zoological Nomenclature* (1953) the name Kitagamiidae Tsuda (1936), being the oldest available name for this family, replaces the later name Limnocentropodidae Ulmer (1951).



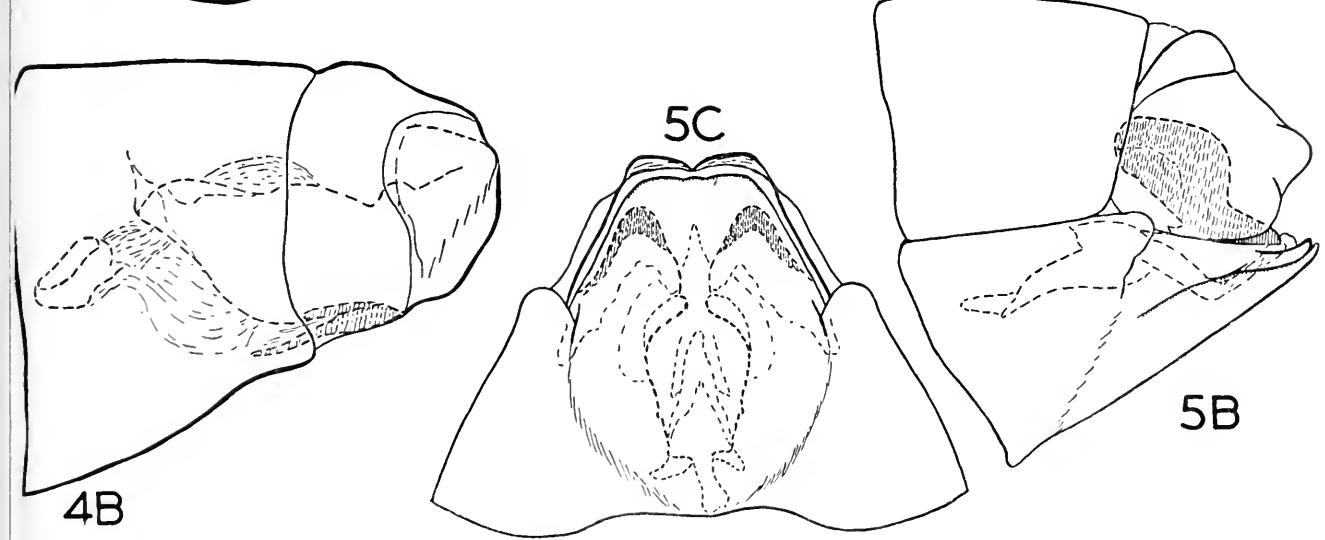
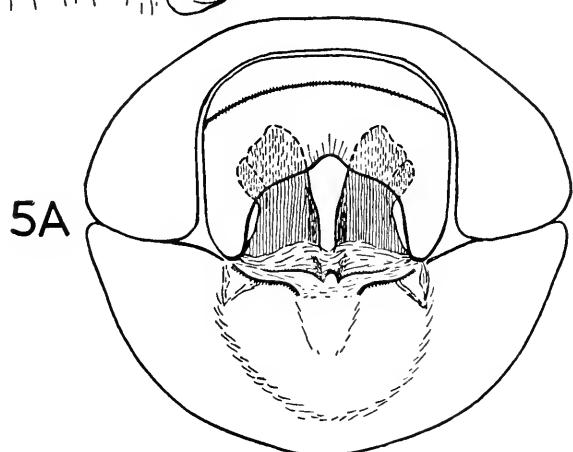
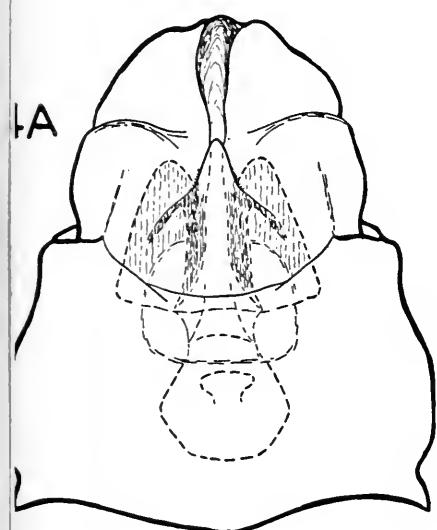
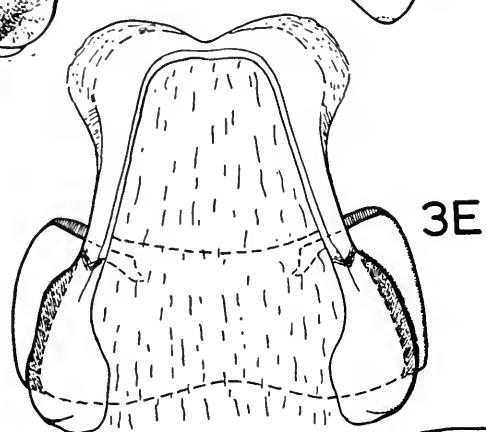
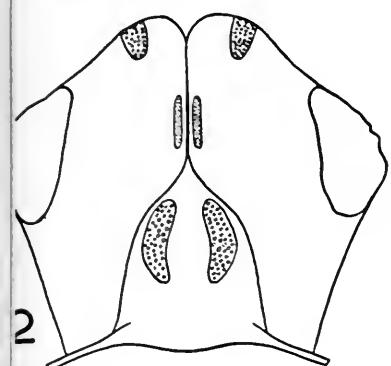
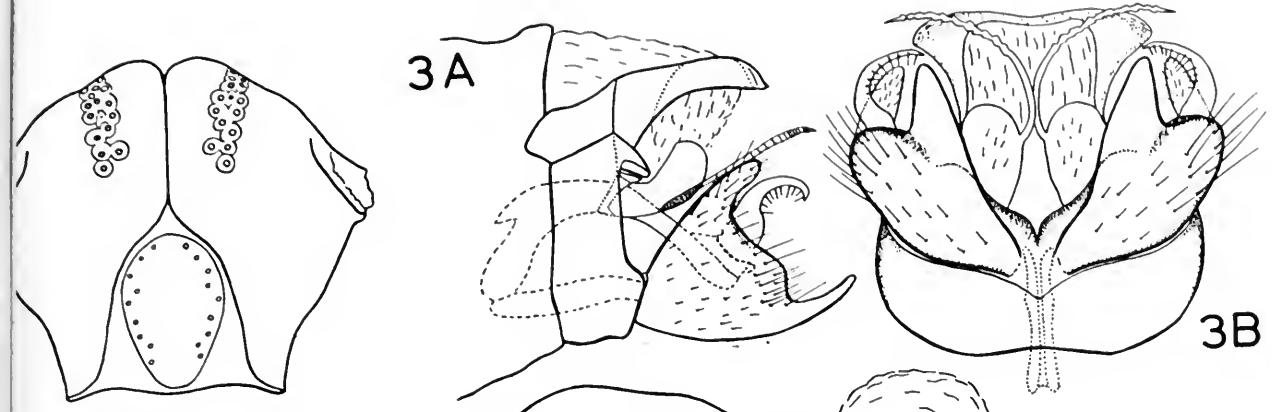
TEXT-FIGURE 1, *Yphria californica* (Banks): 1A, female; 1B, male. (Photograph by F. White.)

do follow a common pattern. For example, the dorsum of the ninth segment of *californica* (Pl. I, fig. 3) is greatly produced posteriorly, resulting in a very deep indentation in the anterior margin of the dorsum of the segment. A clear indication of the same tendency in the ninth segment of *Limnocentropus* males is shown in the figures given by Kimmings (1950). In these species the ninth segment is also produced posteriorly and the same emargination in the anterior edge of the dorsum of this segment is seen in all the species figured. In the overall structure of the male terminalia no close correspondence is apparent between *californica* and the kitagamiids. This discordance is, however, no greater than that between widely divergent genera in other single families, such as the closely related Phryganeidae.

In the terminal abdominal segments of the females a striking difference is apparent. The eighth and ninth segments of *Limnocentropus* (Pl. I, fig. 4) are simple and annular while the tenth appears to be very nearly as complete as the others. In *californica* (Pl. I, fig. 5), however,

#### PLATE I

FIG. 1, Mesonotum of male of *Yphria californica*. FIG. 2, Mesonotum of male of *Limnocentropus moselyi*. FIG. 3, Terminal abdominal structures of male of *Yphria californica*: 3A, lateral view; 3B, ventral view (aedeagus omitted); 3C, aedeagus in lateral view; 3D, end of aedeagus in caudal view; 3E, dorsum of ninth segment in dorsal view (underlying structures omitted). FIG. 4, Terminal abdominal segments of female of *Limnocentropus moselyi*: 4A, ventral view; 4B, lateral view. FIG. 5, Terminal abdominal structures of female of *Yphria californica*: 5A, caudal view; 5B, lateral view; 5C, ventral view.



the sternum of the eighth segment is produced into a prominent subgenital plate which underlies completely the succeeding ninth and tenth segments. In cleared specimens the heavily sclerotized, pointed structures seen through the subgenital plate of *californica* in ventral view (Pl. I, fig. 5C) are similar, however, to those visible through the sterna of the ninth and tenth segments of *L. moselyi* Kimmins (Pl. I, fig. 4A).

The warts of the mesonotum (Pl. I, figs. 1, 2) are clearly different.

In the absence of the immature stages of *californica*, which have yet to be discovered, I believe that the existing evidence of adult structure strongly indicates that this species is more closely related to the Kitagamiidae than to any other known family of caddisflies.

The object of the present paper is therefore to re-describe the imperfectly known *Phryganea californica* Banks and to assign it to a second genus in the Kitagamiidae. Previously this family contained only the genus *Limnocentropus* Ulmer with species described from Borneo, Burma, Sikkim, Assam, China, and Japan. No New World caddisfly has been previously assigned to this family. Kimmins (1950) has given a recent summary of the Kitagamiidae but with the inclusion of a second genus the family and generic definitions require some modification.

### **Kitagamiidae** Tsuda

Kitagamiidae Tsuda, 1936, p. 394.

Limnocentropidae Tsuda, 1942, p. 333.

Limnocentropodidae Ulmer, 1951, p. 382.

Limnocentropodidae Kimmins, 1950, p. 591.

Head short and broad; ocelli present; antennae slightly shorter than the fore wing; maxillary palpi five-segmented in both sexes (Text-fig. 3A), basal segment very short, second long, third still longer, fourth and fifth each a little shorter than the third; labrum elongate; pair of small warts on dorsum of head between ocelli and posterolateral warts. Wings ovate, rather sharp apically; fore wings with thick hair covering; fore and hind wings with apical forks 2, 3, and 5 present, fork 1 intergenerically variable in presence and fork 4 absent (i.e.,  $R_4$ ,  $R_5$ ,  $M_1$ ,  $M_2$ ,  $CU_{1a}$  and  $CU_{1b}$  present,  $R_{2+3}$  sometimes divided and  $M_{3+4}$  not divided); venation alike in both sexes; discoidal cell closed, smaller in hind wing than in fore wing. Tibial spurs 2, 4, 4.

Type genus: *Limnocentropus* Ulmer 1907.

### **Limnocentropus** Ulmer

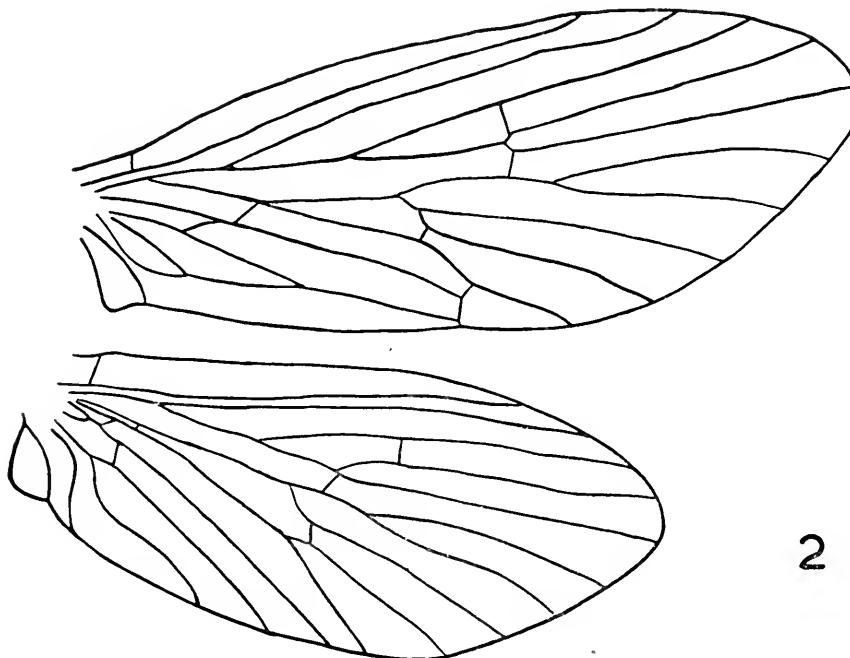
*Limnocentropus* Ulmer, 1907, p. 13.

*Kitagamia* Iwata, 1927, p. 215.

*Limnocentropus* Kimmins, 1950, p. 592.

Eyes with short, sparse pubescence; a pair of warts lying between the anterior warts and the lateral ocelli. Mesoscutum (Pl. I, fig. 2) with two pairs of oval warts, one pair behind the other; mesoscutellum with one pair of warts. Fore and hind wings of both sexes (Text-fig. 2) with  $R_{2+3}$  undivided (i.e., apical fork 1 absent) no apical crossvein between C and Sc in either wing; apical fork 3 in both wings with a footstalk; anal veins of fore wing not connected by a crossvein. Males (several species figured by Kimmins, 1950) with dorsal margin of ninth abdominal segment produced posteriorly and fused with the tenth segment; claspers one-segmented; aedeagus simple, apex generally with a pair of hooks; tenth segment composed of a pair of elongate, lateral plates, the bases of which are fused to the ninth segment; seventh sternum generally produced in a shallow median lobe. Females (Pl. I, fig. 4) with eighth and ninth abdominal segments simple and annular; eighth sternum not produced posteriorly into a prominent subgenital plate; posterior edge of ninth sternum with a pointed median lobe.

Type species: *Limnocentropus insolitus* Ulmer 1907.



TEXT-FIGURE 2, Wings of male of *Limnocentropus moselyi* Kimmins (after Kimmins, 1950).

### ***Yphria*** Milne

*Yphria* Milne, 1934, pp. 4, 8.

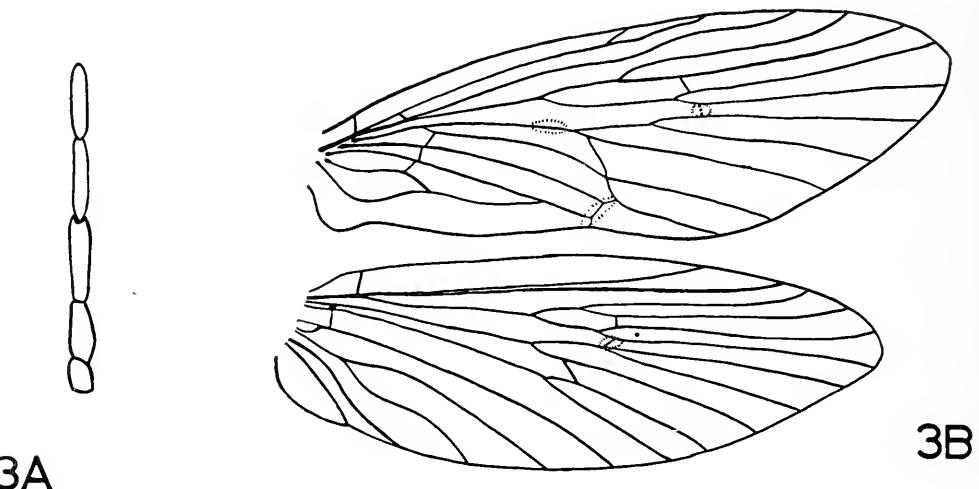
Eyes without pubescence; a pair of small wart-like patches between the anterior warts and the lateral ocelli. Mesoscutum (Pl. I, fig. 1) with one pair of elongate wart-like patches, obliquely situated, with posterior edges approaching the median line; mesoscutellum with a

single large median wart. Fore and hind wings of both sexes (Text-fig. 3B) with  $R_{2+3}$  divided into  $R_2$  and  $R_3$  (i.e., apical fork 1 present). In the fore wing a crossvein between C and Sc, meeting Sc near apex; a crossvein between  $A_1$  and  $A_2$ . In the hind wing apical fork 3 sometimes with and sometimes without a footstalk in the one species.

[With only one species now known, an objective definition of the generic features of the terminal abdominal structures cannot, of course, be given. A full description of these structures for the male and female of the one known form, *Y. californica* Banks, is given below with the description of that species. In selecting the other characters for the definition of *Yphria*, the attempt has been made to balance the more objective analysis given for *Limnocentropus*.]

Type species: *Phryganea californica* Banks by original designation.

*Yphria* was originally described by Milne as a subgenus of *Phryganea* L. in the Phryganeidae. It is here assigned full generic rank in the Kitagamiidae.



TEXT-FIGURE 3, *Yphria californica* (Banks): 3A, maxillary palpus of male; 3B, wings of male.

### ***Yphria californica* (Banks)**

*Phryganea californica* Banks, 1907, p. 117.

Genus ? *californica* Martynov, 1924, p. 213.

*Phryganea californica* Betten, 1934, p. 295.

*Phryganea (Yphria) californica* Milne, 1934, pp. 4, 8.

*Phryganea californica* Ross, 1944, p. 297.

ADULTS (Text-fig. 1). Total wingspan of male 27 mm., of female 33 mm. Total length of male from anterior margin of head to apex of folded wing 14 mm.

Dorsum of head brown and smooth, with white hairs and stout brown bristles and white bristles confined to the warts. Clypeus densely covered with brown bristles, white bristles, and white hairs. Labrum elongate with white hairs. Antennae rather stout with

alternate rings of light and dark brown hairs. Palpi covered with short brown hairs.

Thorax dark brown; warts bearing stout white bristles, brown bristles, and white hairs; median warty area on mesoscutellum with a marginal patch of brown bristles, white bristles, and white hairs on both sides. Legs brown with sparse pubescence; spurs and spines light brown. Fore wings densely covered with intermingled brown and white hairs, with ill defined patches where either brown or white predominate; conspicuous patch of white hairs in the thyridial cell, at the arculus, in cell  $M_2$  and at the corneous spot in cell  $R_4$ ; hyaline areas present in the membrane at the thyridium, arculus, and on crossvein  $r-m$ , almost totally obscuring this crossvein; first apical sector arising from about the middle of the discoidal cell. Hind wings with a moderate covering of short, dark brown hairs, with longer hairs on the anal margin; corneous spot at the base of cell  $R_4$  and a hyaline area around crossvein  $r-m$ . Venation as described for the genus.

*Male terminalia* (Pl. I, fig. 3) with dorsum of ninth segment strongly displaced posteriorly, resulting in a broad, membranous attachment between it and the eighth segment. Claspers two-segmented, basal segment broad and triangular in lateral view; a finger-like lobe on the posterodorsal corner and a thin flange on the posteroventral corner, while between these two projections on the posterior edge of the clasper is a curved, sharply pointed hook, forming the second segment; claspers concave mesally. Aedeagus tubular, strongly arched dorsad in the centre; tip of aedeagus with a heavily sclerotized, narrow, curved plate surrounded by a membranous bulb; base of aedeagus rigidly joined to base of claspers by a pair of elongate sclerotized plates. Tenth segment composed of a pair of flattened, sclerotized plates, with evenly rounded edges; one plate on each side of the aedeagus and each produced mesally into a long, curved process with serrate edges on the distal half.

*Female terminalia* (Pl. I, fig. 5) with posterior margin of eighth sternum produced into a quadrate subgenital plate, and apex appearing truncate in ventral view but in lateral view with three upturned, blunt lobes. The apex of this plate joins dorsally with an enlarged membranous lip leading into the genital opening. Very conspicuous in lateral or caudal view is a pair of heavily sclerotized pillar-like structures, lying immediately beneath the fused terga of the ninth and tenth segments, one on each side of the genital opening.

#### *Specimens examined:*

#### Museum of Comparative Zoology:

1 ♀ — California; Holotype; #11606.  
1 ♀ — Sierra Nevada (Mts.?) ; Crotch; June 10.

1 ♂ — Modoc Co., California; Lindsey Coll.; August 1, 1922.  
California Academy of Sciences:

1 ♂ — Oroville, California; June 25, 1927; H. H. Keifer.  
D. G. Denning Collection:

1 ♂ — Tiltill R., Yosemite National Park, California; August 1,  
1938.

There are two females in the McLachlan Collection in the British Museum. One is labelled California-Walsingham and the other California-Edwards. These have not been examined by the present writer but the genital structures have been compared with copies of the figures in this paper by Mr. D. E. Kimmens.

No other specimens are known to me.

From a re-examination of the holotype, it appears that Banks (1907) in the original description of *Y. californica* misinterpreted certain features of the venation. In the fore wing the white dot described in the base of the third apical cell is actually in the second; the fourth apical cell mentioned is not present; the arculus is not straight as stated. In the hind wing the fifth apical cell is not pedicellate as stated.

In the five specimens available for study, some marked anomalies occur in the venation. In the holotype female and in the male from Modoc County, fork 3 in both hind wings has a footstalk, while this is not present in the other specimens. Fork 5 in both hind wings of the Modoc County male shows a cross connection between the branches of the fork about midway between the forking and the wing margin. The Sierra Nevada female shows a terminal fusion of the two branches comprising fork 5 of the left hind wing, so that the fork meets the wing margin as a single vein. The male from Oroville has an extra terminal branch on  $R_4$  of the left fore wing.

The available evidence of adult structure clearly indicates a close relationship between the Kitagamiidae and the Phryganeidae. This has also been pointed out by other workers, such as Schmid (1955). Features like the ocelli, number of tibial spurs, structure of the maxillary palpi, and general appearance, which are common to both kitagamiid genera give considerable evidence for this relationship with the Phryganeidae. *Yphria californica*, in broadening the structural concept of the Kitagamiidae, has characters which do not occur in *Limnocentropus* but which are found in the Phryganeidae, such as mesonotal warts of the type shown in Plate I, figure 1, a division of  $R_{2+3}$  into  $R_2$  and  $R_3$ , a two-segmented clasper, and a prominent subgenital plate. The close relationship of the two families, at least as far as structural characters of the adult are concerned, is thus further

substantiated. Knowledge of the immature stages of *Y. californica* is a prerequisite for further analysis of these relationships.

All of the localities for *Y. californica* lie in the Sierra Nevada Mountains of California, indicating a general similarity in habitat to that of the known species of *Limnocentropus*, for which all existing records are from elevations of 5,000 to 7,000 feet in Asia. The only precise information on habitat for a kitagamiid comes from Iwata (1927) and Tsuda (1936) who found larvae in a mountain stream near Kyoto, Japan. According to Tsuda the case of *Limnocentropus insolitus* Ulmer is smooth, conical, slightly curved, and composed of small fragments of plant material. Pupal as well as larval cases are fastened to objects with a flexible stalk from the anterior edge of the case. To what extent this information about *Limnocentropus* would hold for *Yphria* is questionable, but it is at best the only indication available of the probable habitat and general appearance of the immature stages of the latter group.

#### ACKNOWLEDGMENTS

I am indebted to Dr. D. G. Denning and to the officers of the California Academy of Sciences for the loan of specimens from their collections. The co-operation of Dr. P. J. Darlington and Dr. W. L. Brown of the Museum of Comparative Zoology during my recent examination of the collection at Harvard University is also gratefully acknowledged. Information concerning specimens in the British Museum (Natural History) was kindly provided by Mr. D. E. Kimmins.

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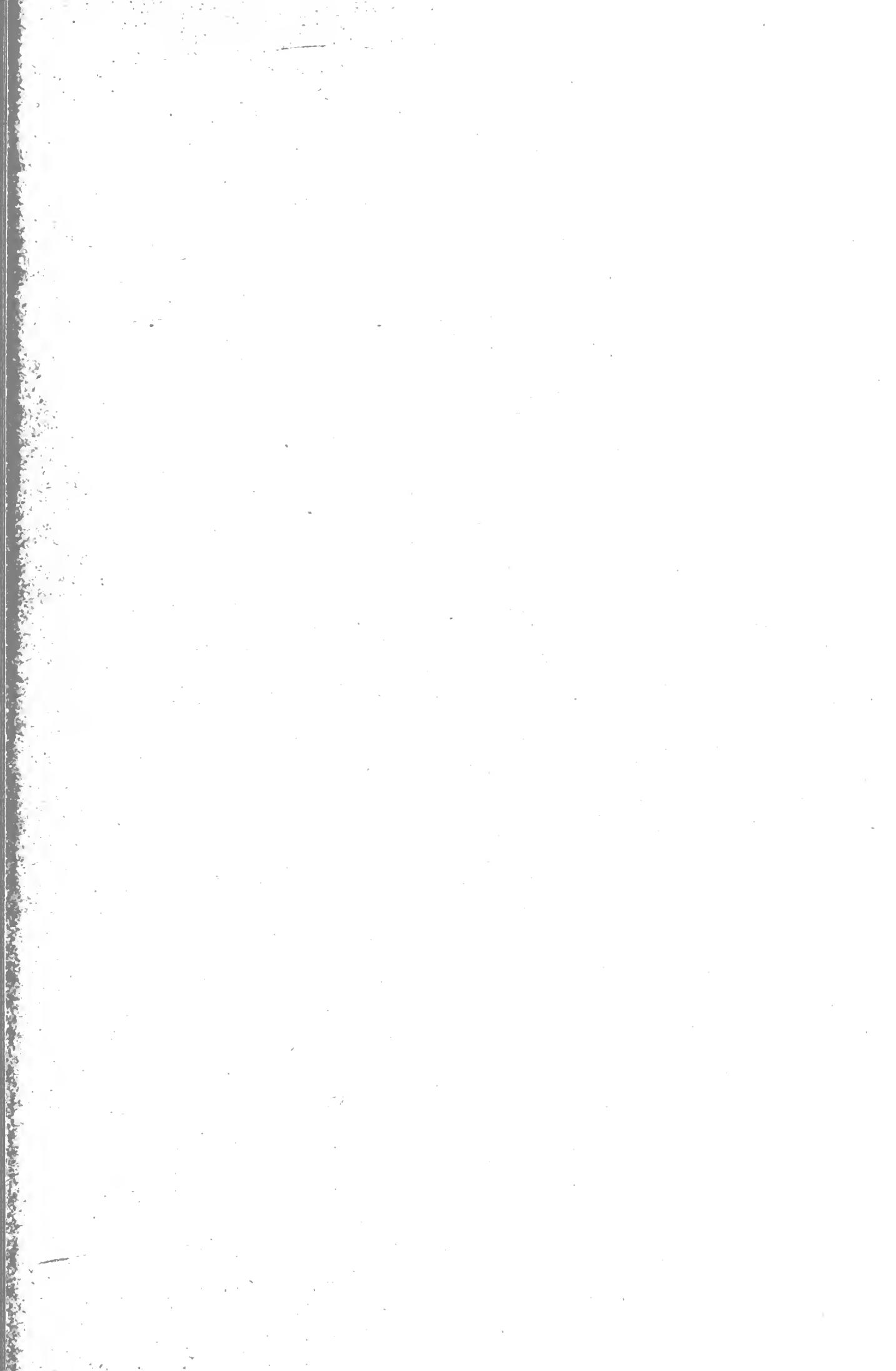
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